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JOURNAL

OF THE

AMERICAN WELDING SOCIETY

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American Welding Society

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AMERICAN WELDING SOCIETY

ESTABLISHED 1919

JOURNAL

Volume 3 November, 1924 Number 11

LOUIS BURTON MACKENZIE

Our friend, Louis Burton Mackenzie, Editor of the Welding Engineer, died at the South Shore Hospital, Chicago, on October 6th, following an attack of pneumonia. He was 44 years old.

Mr. Mackenzie became identified with the American Welding Society from the very start. He helped with the organization and took a keen interest in the Chicago Section of the Society, of which he was the first chairman. Later on he became the chairman of the Membership Committee of the Society.

During the early days of the Society, when we did not have a Journal of our own, Mr. Mackenzie offered the use of the Welding Engineer as a means for communicating with our membership. Time and again Mr. Mackenzie has come to the front with helpful editorials boosting our various activities.

Mr. Mackenzie was born at Richmond, Mich., March 3rd, 1880. He matriculated at the University of Michigan, where he was prominent in athletics. He was a student at Ann Arbor at the outbreak of the Spanish-American War and left the university to become a volunteer soldier in the service of his country.

He was familiarly and lovingly known as "Mac" to everyone with whom he came in contact. He was of Scotch ancestry and proud of it, of his football activities in his college days, and of his service to his country in 1898.

Not only was he active in the affairs of the American Welding Society, but he was well known to the International Acetylene Association, Gas Products Association and the Compressed Gas Manufacturers' Association. These organizations, as well as our own, will miss Mr. Mackenzie at future meetings. On many occasions he has assisted our Board of Directors by his wise counsel and his thorough familiarity with journalistic affairs.

He has left behind two monuments of his interest in the welding industry, the Welding Engineer and the Welding Encyclopedia.

To the Welding Engineer, as well as to the Society, the death of Mr. L. B. Mackenzie is a distinct blow and the loss will be more deeply felt as time passes. We are pleased to advise our members, however, that the Welding Engineer will continue uninterruptedly in the future, just as it did in the past, serving the Welding industry wisely and faithfully and to the very utmost of its ability, retaining the same fine principles and high ideals laid down by its founder, Mr. L. B. Mackenzie.

He is survived by his wife, Gertrude Hungerford Mackenzie; son, Kenneth Burton Mackenzie, and daughter, Margaret Jean Mackenzie.

FALL MEETING—PROGRESS

The 125 members of the American Welding Society that were present at the various sessions of the fall

meeting have unanimously agreed that the fall meeting in Cleveland on Oct. 30 and 31 was a complete success.

Starting out with an address of welcome by Mr. H. H. Dyar of the Cleveland Section and President E. H. Ewertz of the national organization, the visitors were made to feel at home through the hospitality of the officers of the Cleveland section. Hotel Winton proved to be ideal headquarters in every respect. The method of providing a combination luncheon and dinner card for the principal meals served to keep the members together and permitted prompt opening of the various sessions.

Directly after the luncheon on Thursday the members were transported in two large busses to inspect the welding of a 16 in. high pressure steam line for the local power company. These joints were being oxy-acetylene welded. From there the inspection party was taken to the Collingswood Shops of the New York Central Railroad. Parts of the trip through the shops proved to be awe-inspiring. There is something fascinating in watching one of our large monstrous railway engines lifted bodily up in the air. Although considerable welding is being done in these shops, nevertheless it was apparent that a great deal more could be done to advantage. The inspection trip was concluded with a visit to the plant of the Lincoln Electric Co. This plant is taking its own "medicine" in that it is using welding wherever possible in the construction of its motors and generators. Frames are readily made by bending angle irons to form circular sections and welding thereto cross members of steel bars. Compensator tanks are welded throughout at about one quarter of the cost of similar tanks constructed by riveting. The rotor bars of induction motors are welded to the end rings forming an integral whole. Shafting in many cases is made from old pipe by welding to it cross members of light angles. In fact the applications of welding in this plant are examples of the economies which may be effected through the judicious use of this process.

The annual fall banquet met the expectations of the members in every respect. While there were no speeches, nevertheless the entertainment more than made up for this feature. Everyone that was there seemed to be enjoying themselves judging from the compact circle formed around a certain dancer. There were also songs and a moving picture on the "Boons of Electricity to Mankind."

The technical session starting Friday morning was the feature of the fall meeting. About 125 people were in attendance including some prominent structural engineers as well as welding experts.

Mr. R. E. Kinkead presented some conclusions based upon the results of some experiments with riveted rubber plates to magnify action which takes place in the riveted structure under stress. He was followed by an address by Mr. G. O. Carter on "Gas Welded Structures and the Cutting Torch as a Tool in the Structural Field." Mr. Carter advocated the use of pipe sections for structural members. A number of structures built with the use of pipe sections were shown.

The paper on "Electric Arc Welding as a Method of Fabricating Large Structures" was divided into two parts. Mr. W. Spraragen compared the advantages of welding vs. riveting as a method of fabrication and showed the advantages which result from the use of welding. He enumerated a large amount of test and cost data already available in this field. He pointed out that the best results can only be obtained from structures designed only for welding. Mr. W. L. Warner showed a number of slides of structures that have already been built by the electric arc process and some tests that were made on large structures. A bridge truss originally designed for riveting was redesigned by Mr. Warner for use in welding. Each step was explained by him in detail.

The technical session was broken up to allow members to have their luncheon. The City Manager of Cleveland, William R. Hopkins, described what the people of Cleveland were doing through cooperation. He cited as an example the unity of effort in providing for all charitable organizations. This talk was particularly opportune as our own members are accomplishing the same through the united effort in the Welding Society. It doesn't make any difference whether a member favors gas, electric, resistance or thermit welding. They have agreed to unite for the common good and advancement of welding in general. Senator Burton who followed the City Manager of Cleveland showed the need for a greater interest

on the part of the American public in the affairs of the government in order to overcome any tendencies of radicalism. The technical session was resumed directly after lunch by a short talk by Professor H. L. Whittemore of the Bureau of Standards who was representing Dr. G. K. Burgess. Prof. Whittemore stated that welding possesses considerable possibilities in the fabrication of structural parts and that a great deal of data were already available but that more were needed. In securing these data, he offered the cooperation of the Bureau of Standards.

Mr. H. A. Woofter presented a paper on the use of spot welding in the fabrication of large structures. Previous difficulties have now been overcome and the time is ripe, for extended application of the use of spot welding in this field. The most important part of the technical session was the discussion by the structural engineers present. Contrary to popular opinion the steel people are very much in favor of any process which will reduce the cost of fabrication even though in so doing considerable tonnage of steel is saved. Moreover, structural engineers are willing to join with the welding experts in solving the problems that will confront those using the welding process in the fabrication of large structures.

The technical session extended over a longer period than that originally contemplated and it was necessary to curtail the discussion at the Board of Directors meeting. However a number of very important suggestions were brought to light on membership activities and the organization of new sections and section activities. The fall meeting was concluded with some demonstrations Friday evening on "What Can Be Done with Liquid Oxygen." A moving picture was shown on "Oxy-Acetylene, the Wonder Worker" which was followed by lantern slides on the "Application of Welding by the Thermit Process." The projector which was to show the action of the electric arc did not arrive. A description of this apparatus is included in this journal.

WELDED RAIL JOINTS

Progress still continues in the work of the Welded Rail Joint Committee. In April of this year a Second Progress Report was published giving the results of bend and drop tests on joints made by a number of street railways to determine the "present state of the art." Since that time the tensile tests as well as the remainder of the drop and bend tests have been made on this series of specimens. It has been felt by experts that a very valuable test would be one simulating service conditions where a street car in passing begins to pound a defective joint and eventually destroys it. Accordingly a repeated impact machine was designed and built by the Committee to give test joints repeated blows of a magnitude comparable to that given by a car wheel in passing over a cupped joint. Considerable trouble was experienced in getting this machine to operate satisfactorily but it is now pounding away continuously during the day at the Bureau of Standards and plans are being made to operate the machine 24 hours a day. The results of the first series of investigations have given the committee definite ideas as to the important variables which affect the quality of the joints. A series of tests will now be made seeking to improve each type of joint and it has been agreed that the first efforts shall be concentrated on the so-called seam welded type of joint. A careful program has been laid out for this work and thinking it of interest to our members it will be published in the next issue of the Journal.

The small committee that drew up this program is waiting the advice of the main committee and all others interested as to the type of fish plates to be tried out, methods of bringing the rail heads together and the exact technique of preheating to be employed in certain of the joints where this variable is being tested. Our members are requested to send in their suggestions to W. Spraragen, 29 West 39th Street, New York, Secretary of the Committee.

PRESIDENT'S REPORT OF PROGRESS

E. H. EWERTZ

A comprehensive review of the Society's activities was published in the June issue of the JOURNAL by my predecessor, Mr. T. F. Barton.

While we have come through more or less inactive summer months, still certain accomplishments have been made, primarily from the standpoint of organization. New committees have been formed with certain leading members as chairmen, with the hope of establishing a condition permitting the work of the Society to go on continuously and not be interrupted by elections of new presidents each year. The chairmen and members of these committees can continue to serve for a number of years, or as long as the result of their work permits.

The most active committees now functioning are the Finance, Meetings and Papers, and Research committees, and lately to these has been added the Education Committee. It has been very gratifying to see how much work has been accomplished, particularly with the first three-named committees, but it is evident that neither the committees nor their efficient chairmen can accomplish all the work required without assistance of the officers of the various sections and the membership of these sections.

The Finance Committee, and particularly the treasurer's report, indicates our Society to be in a very healthy condition; but, while this is true, much of the work the Society is called upon to do has to be set aside for lack of necessary funds, and the recognition of the Society will increase in proportion to the increase in the membership and, consequently, increase in our finances.

The Membership Committee has brought forth many plans to assist sections to increase their membership and there is evidence received which would indicate that the efforts of this committee are successful.

The officers of the American Bureau of Welding and the chairmen of its Research sub-committees must indeed feel gratified over the successful accomplishments of this department.

The Welded Rail Joint Committee activities, for example, will probably result in the saving of millions of dollars annually to the street railways. The Electric Arc Committee is making some interesting tests in connection with the fundamentals of electric arc welding, as well as the welding of non-ferrous metals.

The technical session of this meeting will bring out many valuable points in connection with the proposed American Bureau of Welding research in the use of welding in the fabrication of structures, and we sincerely hope that with the assistance

of structural engineers and corporations interested in fabrication of structures, as well as with the assistance of the National Research Council, the Bureau will be able to arrange for a research that will be of benefit to all.

The Meetings and Papers Committee is called upon for a vast amount of work, not only in connection with arrangements for the two national meetings, but also in connection with the monthly meetings of the many local sections, and it is indeed fortunate that we have secured such men as are able to do this work in an efficient manner. Our JOURNAL is evidence of very creditable work but it can be, and will be, improved in proportion to the amount of assistance the Editor is able to obtain, not only from the Meetings and Papers Committee, but from the membership at large.

One of the most important fields of activities is the cooperation we can establish between ourselves and other technical organizations, as can be seen from the fact that the Welding Wire specifications of the Society are now universally adopted by such organizations as the American Railway Association, The Society of Automotive Engineers, American Society for Testing Materials, governmental departments, American Electric Railway Association, and many others.

We were shown special courtesy by the American Railway Association at their annual convention, and we have hopes that the relations established will grow and produce big results.

You are all familiar with excellent work in connection with the Boiler Code Committee of the American Society of Mechanical Engineers, particularly the use of welding in the construction of unfired pressure vessels, and, as above-mentioned, on the rail joints in conjunction with American Electric Railway Association.

In all it must be remembered that our affiliation with the National Research Council is the stepping stone whereby a great many of these things have been carried on to successful conclusion.

The Educational Committee lately established will continue the excellent work done by the Training of Operators Committee and give to the trades such information as will make possible the better development of those in it.

The Safety Code Committee does hard work in establishing regulations in connection with the apparatus used in the welding field, and a great deal of good is expected to result from the work of this committee.

The monthly meetings of the Executive Committee, where up to date we have been able to have about 90 per cent attendance, shows the results that may be obtained by cooperation of many men in one line of activity, and, as chairman of this committee, I am exceedingly glad to state that the Society is to be complimented on the time and effort given to the Society by these men. The Society has also been highly complimented on the efforts of the officers of the various sections, many having already reported the full program for the year, and the holding of meetings that have had in them matters of great value to the members.

May I say in closing that with the continued support and cooperation manifest up to this time we will be able to report at our next annual meeting a bigger, better and more useful Society for the benefit of our engineering world.

MEMBERSHIP PLANS

At the Fall meeting of the Society the Membership Committee presented some suggestions for increasing the membership of the Society. No action was taken but it was decided to publish these suggestions in the JOURNAL with the hope of interesting members to comment on same and to offer their cooperation in carrying out such plans as are finally adopted.

While some of these suggestions are new others have been tried with a fair degree of success. The Membership Committee believes that if a careful program were devised that successful results could be expected. These suggestions are as follows:

1. Making public acknowledgment in the monthly journal of the work of individual members in securing new members by publishing a list of these new members and their sponsors.

2. Continuous urging of sections to bring in more members.

3. Offering a prize of a bound volume of the Journal to the member bringing in the most members each month.

4. The sections to make a particularly active drive to bring our membership up to 1000 by January 1st—or to have each member give (by securing a new member) to the Society a Christmas present of a new member.

5. Further consideration of student

members. The plan being to create a new class of membership with annual dues of $2.50, which will be open only to welders receiving instruction.

6. Holding of exhibits in connection with the annual and fall meetings.

7. Securing a complete list of industrial associations and arranging with them to have a section or national officer to speak at their meetings and thus make known the aims and activities of the American Welding Society, to urge either the members of this Association to join our Society or to recommend for membership the man in charge of welding at their plant.

8. Increasing attendance at section meetings. At present at many meetings not over 10 per cent of the membership have turned out. Something should be done to make these meetings more attractive. It is suggested that a large sheet 18 x 22 in. advertising these meetings be hung up in prominent places in offices, shops, etc.

9. A better understanding of the work in sections and their organization on the part of membership at large. At the present time there are two sections which are only partly organized and not functioning properly for lack of something.

10. Organization of new sections. There are prospects of organizing new sections in the Puget Sound District; Birmingham, Ala.; Denver, Colo.; St. Louis, Mo., and Louisville, Ky.

11. Each section should make a list of prospective members in their territory and then definitely assign members to visit these prospects and report at next meeting, and to secure, if possible, such membership previous to the meeting.

12. Establish definite program for section meetings at the beginning of the current year.

WELDED STRUCTURES

The opening shot by the American Welding Society in its endeavors to extend the use of welding in the fabrication of large structures was fired at the fall meeting in Cleveland. Keen interest was displayed not only by our members but also by executives of leading steel corporations, fabricating companies and also structural engineers. We must not let this interest die out. Every issue of the Journal should contain new evidences that welding is being applied in this field. Tests, whether they be service or laboratory, should be described minutely in order to convince the public that welding is adequate for this purpose. Moreover, cost figures and test data which will help draftsmen and designers should in particular be reported.

In this connection it should be pointed out that applications of welding in similar fields or where similar stresses would be thrown on the welds serve as admirable illustrations and examples in this campaign of education.

Some of the larger companies connected with the welding industry at various times must add to their shop and office facilities. They should be willing to take their own medicine and fabricate such structures by welding. However, this step alone would not solve the problem. An added requirement is that they must report it to the American Welding Society, outlining the difficulties and how they were overcome, keeping accurate data as to the cost, methods, inspection, etc. Let us all get behind the movement. It is the only way to success.

INFORMING THE PUBLIC

It has generally been agreed among readers of the welding industry that one of the best methods of extending the use of welding is to inform the public what welding is, how the process is carried out, what are some of the factors involved in making good welds and what are its possibilities.

From time to time talks have been given by various members of the Society before other engineering societies, club meetings, etc. All of these efforts help the good cause, and it is suggested that concerted action be taken by the welding fraternity through regularly staging such meetings.

A recent example of such a meeting was that in Buffalo, at which time Mr. J. J. White, President of the General Welding Works, addressed the Lyons Club on the Value of Welding.

QUESTIONNAIRE ON ALUMINUM WELDING

In order to obtain information on the subject of aluminum welding Mr. T. A. Wry, Chairman of the Boston Section, has sent out a questionnaire to a number of members of the Society and the information so received will be compiled for publication in the Journal. Members are urged to supply this information as promptly as possible. In order to reach all of our members who have had experience in

this field this questionnaire is reproduced below. All answers should be sent to Mr. T. A. Wry, General Electric Co., River Works, Lynn, Mass.

1. Have you a Welder in your Section who can weld aluminum?
2. How thin aluminum can he weld?
3. By what process?
4. What flux does he use?
5. How many inches per hour can he weld?
6. Will he read a paper prepared by himself on welding aluminum?
7. Will he submit samples welded by himself?
8. If the welder will not prepare the paper, will he give the information to some one in your Section who will?
9. How long before the paper will be presented?

READING THE JOURNAL

From the many congratulatory letters which we have received during the past two and one-half years, we may safely assume that the Journal of the Society has been well received by the entire membership and highly appreciated.

How many of our members, however, really read all the articles that are published therein? How many, on the other hand, glance through the titles and file away the Journal for future reference?

One of the reasons for becoming a member of the Society was a desire to keep in touch with all the latest welding developments. This can only be done by actually reading the articles as they appear from month to month and not by filing them for future reference.

The Journal is printed in type of such size and character that easy reading is possible. It would only take a comparatively few number of hours to read it through from cover to cover, including a careful review of all the advertisements.

Sometimes a particular author may present his subject in a different way than you would do it. Sometimes the subject might be one in which you would want to get further information. Again, in other instances you might be able to have some new ideas on the subject yourself. The Society can get the best benefit from its membership and vice versa the members from the Society only if every member reads thoroughly each printed page of the Journal.

SECTION ACTIVITIES

Boston

The October meeting of the Boston section was held on Friday the 24th, at the factory of the Thomson Electric Welding Company. A tour of inspection at the factory was made after which the 100 members present assembled in the drafting room. Mr. H. A. Woofter, electrical engineer of the Thomson Electric Welding Company presented a paper, assisted by the other members of the company. After a short summary of welding from the earliest known applications to the present, Mr. Woofter presented a paper illustrated by lantern slides on different forms of resistance welding. Slides of welded parts were shown from delicate surgical instruments and kitchen utensils to parts of automobile and mining machinery.

After the lecture the members in parties of ten under the guidance of employees, adjourned to the shop where there was on display samples of various welded articles.

Practical demonstrations were given of spot welding of steel, aluminum, and brass, seam welding of two sheets of .038 steel at 60 ft. per minute, welding 1½ in. tubes, safe ending 5½ in. superheater tubes, butt welding nichrome, slow butt welds, contact flash welding of steel bars and brass bars.

The next meeting will be held at the Boston City Club on November 21. Mr. C. J. Holslag of the Electric Arc Cutting and Welding Company will present an interesting address on "The Uses of Flux in Electric Arc Welding." In addition Mr. F. A. Philcrantz, foreman of the Welding Department (Gas and Electric) of the General Electric Company, River Works, will read a paper on "How Shop Problems Are Overcome."

Chicago

The regular scheduled paper for the November Meeting by Mr. David Ahldin on "Acetylene" was postponed for a later date. Mr. E. L. Swangren of the Western Electric Company of Chicago gave an extemporaneous talk on the "Application of Welding at the

Plant of the Western Electric Company in Chicago." Mr. W. A. Slack, president of the Torchweld Equipment Company, talked to those present about the Cleveland meeting. Mr. Mason, chairman, presented an invitation to those present, received from the secretary of the International Acetylene Association, Mr. A. Cressy Morrison, to be present at the convention of this association to be held in Chicago next week. An unusual feature of the meeting was the attendance of many new men, who have not been seen at the meeting before. In order to secure a larger attendance and to interest new members, the Chicago Section is sending out a large number of notices for its section meetings.

Western New York

The Western New York Section reports that in order to interest the largest possible number of people they are holding meetings in the classrooms of several technical schools of the city. Prospective welders, foremen, superintendents, managers and proprietors of plants using and working on all kinds of ferrous and nonferrous metals regularly receive notices of these meetings. A schedule of the coming meetings is given below:

Nov. 12, 1924, Rochester, N. Y., "Arc Welding by the D. C. Process," W. P. Madden, care of General Electric Co.

Dec. 17, 1924, Buffalo, N. Y., "Arc Welding by the D. C. Process," James Burke, President, Burke Electric Co.

Jan. 14, 1925, Rochester, N. Y., "How Heat Affects Steel, Especially in Welding," S. W. Miller, Union Carbide and Carbon Research Laboratory.

Feb. 18, 1925, Buffalo, N. Y., "Welding and Cutting by Oxy-Acetylene Process," Air Reduction Sales Co.

March 18, 1925, Rochester, N. Y., "Resistance Welding," M. G. Littlefield, Thomson Electric Welding Co.

April 15, 1925, Buffalo, N. Y., "Cutting and Welding by Carbon Arc," S. L. Walworth, Acheson Graphite Co.

May 20, 1925, Rochester, N. Y., "Welding and Cutting by the Oxy-Acetylene Process," Air Reduction Sales Co.

Pittsburgh

The October meeting of the Pittsburgh section was held on the 17th. Mr. Andrew Smith, of the Smith Metal Perforating Company delivered a paper on "A New System of Arc Welding and Cutting."

The November meeting will be held on the 21st. Mr. T. F. Copeland, Engineer of the Carnegie Steel Company, Homestead Works, will present a paper on "Reclaiming Worn and Broken Parts of Machinery."

Philadelphia

The November meeting of the Philadelphia section was held on Nov. 17. Col. Royal Mattice, President of the Mattice Engineering Company, presented a paper on "Safety in Welding." The motto of the company with which the speaker is connected is "Service Before Profit." If the management does not feel that a successful job of arc welding can be performed they frankly tell the customer that it would be better to buy a new article as they cannot guarantee the work.

San Francisco

The regular monthly meeting of the San Francisco section will be held on October 17 in the Engineers Club. Mr. W. R. Blair, manager of the American Cast Iron Company will present a paper on the "Welding of Cast Iron," bringing out many points in connection with the brazing and welding of same.

New York

"Advantages and Scope of Applications of Resistance Welding in Structural Manufacture," was the title of a paper presented on November 12 before the metropolitan section of the American Welding Society by H. A. Woofter, electrical engineer, Thomson Electric Welding Company. The paper dealt with resistance welding as applied to manufacturing production and about 100 lantern slides were shown to illustrate types of resistance welding machines and specimens of the work performed by these machines.

A great variety of applications were shown varying from the welding of watch stems and spectacle mountings to the welding of drop forgings requiring 500 kva. and making two welds per minute. Mr. Woofter stated that all ferrous and all non-ferrous metals with the exception of tin could be welded by the resistance process and that any one of these metals could be welded to any other. Some of the outstanding

operations described were as follows: Duralumin welds which, due to the fact that they are welded almost instantaneously, do not require heat treatment; chain made by welding two U shape pieces together so that there are two welds in each link; 2-in. pipe welded at a rate from 100 to 150 feet per minute.

A lively discussion followed the presentation of the paper and a brief address was made by E. H. Ewertz, president of the society. Mr. Ewertz stated that the substance of the paper provided a good example of how little each welder knows about welding, in spite of the fact that he may have been engaged in the work for years and be laboring under the misapprehension that there is little left to learn. He said that if every member knew what was to have been presented by Mr. Woofter the meeting room would have been filled. Mr. Ewertz also described the annual fall meeting which was held at Cleveland, Ohio, and elaborated on the possibilities of welding in the field of fabricated steel structures. He pointed out that while most of the information compiled by the members of the society appears in the Journal, the members cannot realize the real benefit of the society without attending the meetings. "It is only by attending the meetings," he said, "and listening to the way in which the discussion is presented and by taking part in the discussion that the members can keep themselves intimately acquainted with what is going on in the field.

List of New Members for Month of October

BOSTON

H. P. Peabody (B), Salesman, J. A. Roebling Sons Co., 93 Pearl St., Boston, Mass. Proposed by T. A. Wry.

CLEVELAND

A. B. Chapman (C), Super. of Welding, C. & O. Railroad, (res.) 1821 9th Ave., Huntington, W. Va. Proposed by R. K. Randall.

Roy J. Hurt (C), District Sales Manager, Purox Co., 2020 East 22nd St., Cleveland, Ohio. Proposed by R. K. Randall.

John C. Menzies (C), Sales Manager, Burdett Oxygen Co., 3300 Lakeside Ave., Cleveland, Ohio. Proposed by Hugh Dyar.

C. W. Joiner (D), Electric Welder, (res.) Springboro, Pa. Proposed by R. P. Palmer.

Thomas Perkio (D), Electric Welder, (res.) Sherman St., Conneaut, Ohio. Proposed by R. P. Palmer.

Phillip Sanford (D), Electric Welder, (res.) 450 Liberty St., Conneaut, Ohio. Proposed by R. P. Palmer.

Paul S. Usher (D), Electric & Acetylene Welder, (res.) Conneaut, Ohio, R. F. D. Proposed by R. P. Palmer.

G. A. Williams (D), Welding Engineer, Air Reduction Sales Co., (res.) Linesville, Pa. Proposed by R. P. Palmer.

KANSAS CITY

Wm. R. Smith (D), Box 119, Coffeyville, Kan. Proposed by C. L. Finch.

NEW YORK

J. L. Dubois (D), 11 Van Cortland Park Ave., Yonkers, N. Y. Proposed by A. F. Keogh.

WESTERN NEW YORK

L. B. Beath (B), Manager, W. D. Beath & Son, Ltd., 394 Symington Ave., Toronto, Canada. Proposed by G. W. Swan.

Roy L. Bright, M.M. (C), 26 Strathmore Ave., Buffalo, N. Y. Proposed by G. W. Swan.

John Furrie (C), Electric Engineer, 16 Bloomfield Ave., Buffalo, N. Y. Proposed by G. W. Swan.

J. W. Gruenberg (D), Welder, 16 West 2nd St., Dunkirk, N. Y. Proposed by Robt. Siemer.

Frank Watson (D), Welder, 170 Gibson St., Buffalo, N. Y. Proposed by G. W. Swan.

PHILADELPHIA

John J. Dunne (B), Sales Manager, Paschall Oxygen Co., 73rd & Woodland Ave., Philadelphia, Pa. Proposed by J. W. Meadowcroft.

H. E. Hopkins (B), 709 W. Huntington St., Philadelphia, Pa. Proposed by C. W. Bates.

Francis C. Crowell (D), 4533 Fern Hill Road, Philadelphia, Pa. Proposed by J. W. Meadowcroft.

PITTSBURGH

H. E. Hollis (B), P. O. Box 681, Pittsburgh, Pa. Proposed by J. D. Conway.

SAN FRANCISCO

W. H. Cortelyou (C), 529 Howard St., San Francisco, Cal. Proposed by W. B. Sawyer.

Geo. Brolin (D), Frederick Apts., 41st & Telegraph Sts., Oakland, Cal. Proposed by D. J. Williams.

T. C. Crossett (D), 1178 McAllister St., San Francisco, Cal. Proposed by J. C. Bennett.

W. D. Eaby (D), Welder, Associated Oil Company, (res.) Martinez, Cal. Proposed by J. C. Bennett.

D. J. Phillips (D), Acetylene Welder, Associated Oil Company, (res) 224 Ward St., Martinez, Cal. Proposed by J. C. Bennett.

SOCIETY

A. J. Smook (D), Electric Welder, (res.) Box 337, Harrison, Ark. Proposed by J. M. Parsons.

EMPLOYMENT SERVICE BULLETIN

Opportunities.—The Society is glad to learn of desirable opportunities from responsible sources, announcements of which will be published without charge in the BULLETIN.

Services Available.—Under this heading brief announcements (not more than seventy-five words in length) will be published without charge to members. Announcements will not be repeated except upon request received after an interval of three months; during this period, names and records will remain in the office reference files.

Note.—Copy for publication in the BULLETIN should reach the Society's Office not later than the thirtieth of the month if publication in the following issue is desired. *ALL REPLIES should be Addressed to the number Indicated in Each Case and Mailed to Society Headquarters.*

Positions Vacant

V-18. Acetylene welder wanted in Philadelphia, experienced in all metals. Full particulars first letter, hourly rate and names of employers for past three years. Electric welding knowledge helpful but not essential. Expenses refunded if competent after three months.

V-19. Electric welder wanted in Philadelphia with cast iron experience. Full particulars first letter, hourly rate and names of employers for past three years. Acetylene welding knowledge helpful but not essential. Expenses refunded if competent after three months.

V-20. Wanted. Acetylene welder with experience in electric welding to take charge of production shop. Give full particulars of past experience and present employment in first letter. All information will be treated confidentially.

Services Available

A-28. Demonstrator and Salesman available. Regular go-getter with 8 years' practical experience on oxy-acetylene torch and regulator repairs, etc. Am 27 years of age, married and can furnish first-class references from several of the leading equipment firms of the U. S. A. Desire opportunity where hard work and good results are appreciated. Southern states preferred.

Oxy-Acetylene Welding and Cutting in the Structural Field*

By G. O. Carter†

Practically everyone who is closely connected with the American Welding Society knows how extensively oxy-cutting is used for trimming structural shapes to dimension. In bridge and tank shops the cutting flame is very extensively used in making angle cuts on beams, difficult copes, or re-entrant angles and port holes in plate. When assembling big columns and girders, it is used constantly to trim over-sized pieces. The cutting blowpipe is such a labor saver that it has been added to practically every steel construction gang. It puts in a needed rivet or bolt hole, removes a protruding rivet head or interfering detail with the utmost dispatch.

A great deal could be said about the use of the oxy-acetylene welding process in the upkeep of equipment and the welding of pipe, which goes in practically all big buildings. It is safe to say that any construction organization that does not have a good maintenance welder on each of its big construction jobs is missing an opportunity to keep down repair costs and keep equipment in steady operation. This phase of matters is, however, not considered as the principal subject under discussion and the countless advantages of ox-welding for maintenance and repair work will not be enlarged upon here.

Some very clever thinkers have even realized the possibilities of cutting beams, angles and plates, like a tailor would cut cloth. An interesting case of this use is in the recent construction of a steel caboose at one of the steel mills. Only two or three such cars were needed and where it would hardly have paid to make detailed drawings and layout templates for fabricating the car, which would be the general practice. Also at one industrial plant I have in mind, the steel skeletons of several very large buildings were constructed entirely with stock and second-hand beams. With only a general drawing of the requirements, the engineer in charge was able to erect the building much like an old-fashioned millwright works in wood—the beams and posts are cut to fit the needed spaces and connections made with bolt holes drilled with the oxy-acetylene flame.

In building construction it frequently occurs that some change is made in a design after the steel is ordered. This necessitates change in beams in the field and is almost invariably carried out by tailoring methods with the cutting torch.

In all this, however, oxy-acetylene welding and cutting are nothing more than useful tools in the steel-worker's kit, helping

*Presented at the Fall Meeting American Welding Society, Oct., 1924.
†Consulting Engineer, Linde Air Products Co.

him to make the old-fashioned riveted joints the more easily. It seems to me that the big problem in the structural field at the present time affecting the American Welding Society is the possibility of making a welded joint instead of a riveted connection. It might be well for us to consider several phases of that situation.

There is very little question but that the properly made oxy-acetylene weld is the best joint that can be made. The problem before structural engineers, therefore, seems to be the design of structures which use this best joint.

At the present time structural steel frames and members are made with flat plates or sections having flat surfaces to permit

Fig. 1.—The Cutting Torch Is an Eveready Efficient Tool for Cutting Plates or Boring Rivet Holes

riveted connections. As long as rivets or bolts have to be used such sections will be required.

Many years ago when metal was first being used for important structures a great many designers used tubular columns, because from a theoretical point of view, the tube is the strongest column for the weight of metal, provided its length does not exceed a certain percentage of its diameter. However, joining tubular sections with rivets at their intersections is so extremely difficult that the use of tubular construction in framed structures was soon abandoned. It survives only in the form of round building columns for small buildings—say, up to 3 or 4 stories high. However, the advent of oxy-acetylene welding has entirely changed the jointing problem. Within the past four or five years quite a few shop buildings, warehouses and garages have been built in the United States and in Europe using pipe for all important members, the members being joined together by oxy-acetylene welding. Furthermore, the Army Air Service has adopted tubular members,

welded at the joints by the oxy-acetylene flame, for standard construction on all air craft fusilages. The world cruisers were made in this way.

Naturally there must be some engineering study of the strength of columns, of the truss design and of the proper treatment of the intersections, so that there will be ample strength and yet full advantage be taken of the ox-welded tubular construction.

This brings us face to face with conditions which are being constantly brought to our attention where engineers and contractors wish to apply ox-welding to the present form of construction.

Fig. 2.—Cutting Structural Shapes

Following the present designs using flat members or special shapes, fullest advantage is not taken of the strength of the materials nor of the ox-welding process. If an attempt is made to simply substitute a lap weld or even a limited number of tack welds in place of a rivet, the inducement is only a matter of saving in cost of construction. This will only be a very small percentage of the total expense. Improvement in design permitted by the use of the tubular construction with the ox-welded joint will on the other hand permit big savings in weight, improved designs and less expensive fabrication operations.

One of the big problems in undertaking structural work has always been a supply of qualified welders. On that account the management of big construction companies have been slow to consider welding. We now know much more about the problem of the competent worker, for within the past two or three years several big welding organizations have been brought together on pipe line jobs and the principles of organization of a welding gang have been quite thoroughly developed. If anyone now desires to do a large amount of welding with the oxy-acetylene process and will follow the principles already advocated for the selection and training of welders, very little difficulty should be experienced. Of course, welders must be supervised by competent foremen and the work should be tested so as to insure proper welds.

There is nothing mysterious about the making of good oxy-acetylene welds 100 times out of 100 which will be fully up to the strength of the material itself. This also has been demonstrated several times within the past two or three years. Certain well-known principles must be followed: To be absolutely up to the full strength of the material, the weld should be made from two sides

Fig. 3.—Oxy-acetylene Structure for Supporting Tank

and with filler material of a quality equal to that of the structural material being employed.

Where the best principles of welding cannot be followed, welds can be relied upon for the strength of over three-fourths of that of the structural material, when made with proper filler materials by competent operators. In designing structural shapes, engineers should appreciate just what can be depended upon and they should

not hesitate to call in engineers who are devoting their entire time to studies of the welding process.

A recent development in ox-welding is the use of bronze filler rods in place of steel filler rods in structural steel construction. A flux is used for applying the bronze to the abutting edges of the steel. Then the space is filled in with bronze. This is distinctly different from brazing which has always been done along the contact edges on lapped surfaces and has never been used as a filler material.

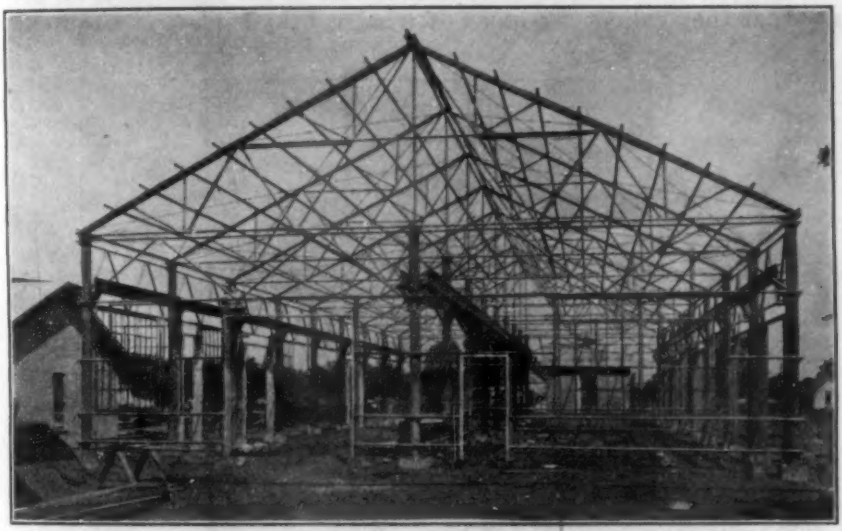

Fig. 4.—End View of Welded Portable Warehouse Building. Dimensions 50 ft. by 120 ft. Constructed of junk pipe. 8 in. columns with 2 in. girts and purlins. Trusses made up of 4 in. "A" frame with 2 in. bracing. Plates for columns and trusses cut from junk tank iron. Constructed by the Prairie Pipe Line Company at Caney, Kansas.

The use of bronze filler rod instead of steel very materially reduces the heat effect on the structural shapes, enables the filler material to be deposited faster and effects a saving in the gases (which offsets the increased costs of the rod). Bronze-welding, as the new process may be called, can be learned in a few hours by an experienced oxy-acetylene welder. The strength of the joint is very high; welds made from one side are practically as strong as similar welds with Norway iron filler material. When the best possible joint is used with bronze the strength of joint is fully up to that of the structural material itself. When changes of designs cannot readily be made to the tubular sections as is advocated in the above notes, the use of the bronze filler material on lapping edges is decidedly advantageous and gives a joint with as high strength as any other form of construction.

All told, there is every reason to believe that oxy-acetylene welding will soon be used very much more extensively in the structural field than at present, particularly with the development which is being made in the use of bronze filler material.

Optical Projection of Arc Welding*

F. DAVIS†

In the ordinary demonstration of arc welding it is necessary to provide each spectator with an eye-shield, and the number of persons who can see the demonstration at any one time is limited to the number that can actually crowd around the man doing the welding; and, even then, most of them are so far removed from the arc that they cannot see much of what is taking place in the weld.

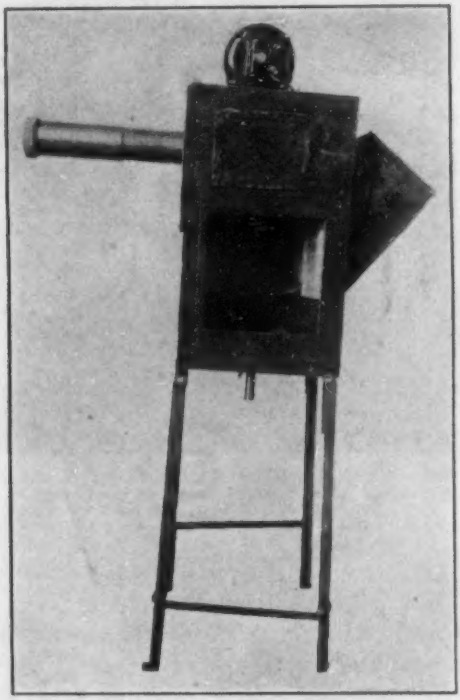

Fig. 1.—Optical Projector of Arc Formed While Welding

In order to more clearly bring out the details of arc welding and to make it possible for a large audience to witness a demonstration, the machine described below was built. This machine is used in connection with any stereopticon or moving-picture screen, the only other apparatus needed being the outfit for semi-automatic welding or hand welding. The illumination and ventilation of the projector is supplied from a single-phase 220 volt circuit.

Fig. 1 is a photo of the projector which shows the lens tube,

*Scheduled for Demonstration at Fall Meeting, American Welding Society, Cleveland, Oct., 1924.

†General Electric Co.

the ventilating motor, and one of the illuminating chambers, the other one being at the opposite side from the observer.

Fig. 2 shows the machine in cross-section, in order that its action may be understood. Referring to the sketch, A is a copper plate, which serves as a table upon which the welding is done. It is connected to the positive lead from the welding generator and is adjustable as to height, this adjustment being necessary to centralize the light from the two illuminating chambers, as the thickness of stock being welded varies.

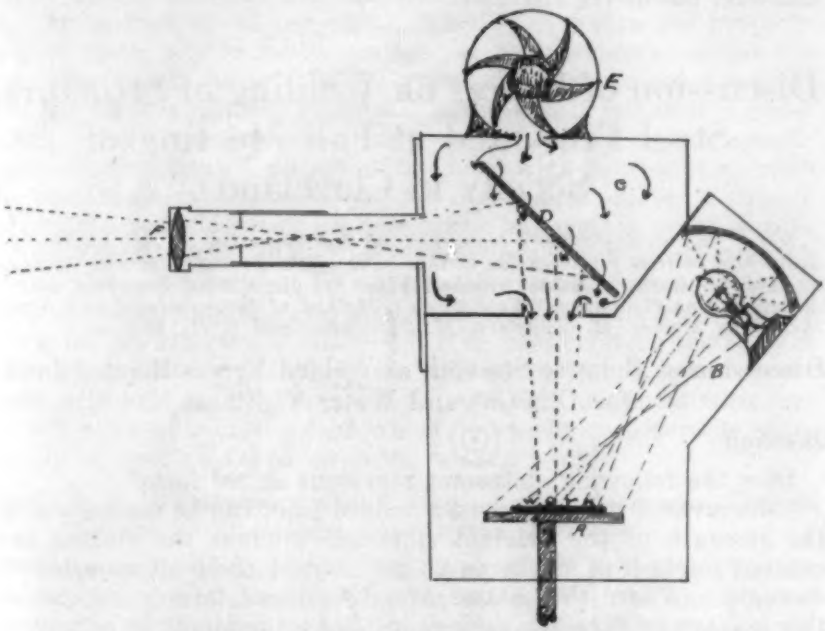

Fig. 2.—Cross Section of Projector

B is one of the illuminating chambers. In this chamber there is a stereopticon lamp and a silvered glass parabolic reflector from which the light rays are focused upon the work for illumination.

C is a chamber in which is located the mirror D. E is a blower, and F a double convex lens having a 30-inch focus.

In use the machine is set up about 30 feet from a screen, and a piece of steel plate, or other material which it is desired to weld, is placed on the copper work plate, in which position it is in direct line with the mirror. From the mirror the image of the work is reflected through the lens and on to the screen, due to the intense illumination of the work from the two parabolic reflectors.

An arc weld, using either a carbon or a metallic electrode, is then made upon the plate, and its perfect image, magnified many times, is shown upon the screen. Due to the intensity of the light in the arc, every detail is shown very clearly; the vapor stream, the melt-

ing of the electrode, the puddling and cooling of the metal, the forces at work in the crater and the magnetic disturbances.

At a distance of 30 feet from the screen the machine shows an image of the arc which is about 18 inches in diameter; quite large enough, in fact, to make a study of what takes place.

The blower at the top of the machine is to protect the mirror and lens from smoke and dust. The blower keeps a supply of air in the chamber C, which has an exit only through the bottom opening of the chamber. This downward movement of air keeps all smoke and dust out of the chamber.

Discussion of Papers on Welding of Structural Steel Presented at Fall Meeting of Society in Cleveland

Note: The stenographer's transcript of the discussion of this meeting did not arrive in time for inclusion in this issue of the Journal. It will, however, be published in the December number. There are given below some brief written discussions on the paper, "Welding as a Method of Fabricating Large Structures," by Messrs. H. Goldmark, W. Spraragen and W. L. Warner.

Discussion of Relative Strength of Welded Versus Riveted Joints for Oil, Gas and Water Tightness

Question

Does the following statement represent actual facts?

"Moreover if properly done a welded joint can be made equal to the strength of the original material, whereas the riveted and caulked joints leak as low as 25 per cent of their ultimate tensile strength. Where thicknesses are determined largely because of this leakage feature, the savings in steel alone might be as high as 50 per cent."

Answers

R. E. Wagner, Assistant Manufacturing Superintendent, Pittsfield Works, General Electric Company—

"As a general statement, I would say that a welded joint was superior to a riveted joint, and I believe that that part of the statement which refers to a riveted and caulked joint leaking under a strain of 25 per cent of its ultimate strength is about right, but I question what is meant by "ultimate tensile strength" as the rivets are usually under a shear, and the plate under tension. It might be better to say "ultimate strength" rather than "ultimate tensile strength" or "shear strength."

"The factor—25 per cent—would refer, I presume, to a single row of rivets, and would change, depending on whether we had a single, double, triple or quadruple row of rivets. I would say this percentage would be about right for a single row of rivets; 30 per

cent for a double row; 35 per cent for a triple row and 40 per cent for a quadruple row. The percentages stated are estimates from experience, but not from actual tests. The savings in thicknesses of steel in some cases may run as high as 50 per cent, as stated."

W. H. Heinrich, Engineer, Travelers Insurance Company, Hartford, Conn.—

"Properly riveted joints, if of quadruple construction, may run as high as 94 per cent of the strength of the original material and if the joint is of quintuple butt strap construction, the efficiency may be as high as 95 per cent. When such joints are properly caulked there should be no leakage at any pressure within the range for which the joint is designed. It seems to me, however, that the point which this particular paragraph is intended to cover refers to the immense saving which may be effected by using welding instead of riveted construction, this saving having to do with the plate material required. If, for instance, a builder wishes to construct a vessel for a specific pressure, he must, in order to save plate material, design all joints to have as near the original strength of the plate as possible. In using welded construction he merely joins the plate together and makes his weld of sufficient strength to get the desired result. However, if he uses riveted construction, he must, in addition to butting the ends of the plate together, cover them with butt strap both inside and out and join them with four or five rows of rivets, all of which represent considerable extra weight of steel as compared to the welded joint."

Prof. H. L. Whittemore, Chief, Engineering Mechanics Section, Bureau of Standards, Washington, D. C.—

"There is some question of the propriety of stating that the welded joints can be made equal to the strength of the original material. While this is possible with exceptional design and workmanship, it seems preferable to modify the statement somewhat.

"We have very little data on the pressure at which riveted tanks leak. Presumably, the tank could be made tight until the yield point of the material, either in the plates or rivets, was reached. With good design this might be approximately half the ultimate strength."

Welding 1,000 Foot Pipe Line

B. S. HAVENS†

An ingenious application of electric arc welding was recently made by the master mechanic of the Northwestern Improvement Company at Roslyn, Washington. A 1000-foot pipe line was to be constructed.

A number of 4-inch B. & W. boiler tubes had outlived their use-

†News Bureau, General Electric Co.

fulness and had been consigned to the scrap heap. The pipe line to be constructed called for 4-inch pipe and the boiler tubes were 4 inches outside diameter. Sleeves were cut from 4-inch standard pipe about 4 inches long, into which the ends of the tubes, previously sawed off square, were slipped until they butted together. The ends of the sleeves were then welded solid to the tubes.

Another line was constructed of Stirling tubes. These were 3¼ inches outside diameter and nothing was available from which to cut sleeves. The damaged ends were cut off square, one end of each tube was brought to a red heat in a forge and then expanded by driving a mandrel into it about 3 inches. The plain end of the next tube was then forced in as far as it would go and welded.

No expansion joints were used, as both lines were to carry water and were to be buried in a ditch. The ditch had a number of bends in its course, and to avoid the use of flanges the pipe was welded on supports over the ditch and then bent to conform to the ditch with a jack and chain, after which it was lowered into place.

Flanges were necessary to connect the pipe to other lines and these were bored smooth on the inside and the tubes expanded into them with a tube roller.

Gas Welding and Cutting in the Automotive Industry

W. A. SLACK†

Very few users of the Oxy-Acetylene process for working metal realize just how much gas welding and cutting enter into the production and repair work of the great automotive industry. The application of the Oxy-Acetylene process is so extensive in this industry at the present time that many manufacturers of automobiles, auto trucks, automobile and truck bodies, parts and accessories for this great industry are using hundreds of welding and cutting oufits.

As a result of the continually increasing application of this process it has been possible to simplify and strengthen much construction which otherwise would have been too expensive or impractical to manufacture.

In addition to the many manufacturers of automobiles and automobile parts who are using hundreds of torches daily in production work there are literally thousands of concerns using one or more torches for general repair work throughout the country. When you realize that one concern has bought six hundred and seventy-eight (678) welding torches and another five hundred and forty-six (546) during the past four years you can begin to appreciate the great part gas welding plays in the automotive industry. It has become not only a very large earning factor in production work

†President, Torchweld Equipment Co.

and a money maker for the repair man or repair department of any garage or service station, but also a saver of much time and labor in general service work.

Queer as it may seem, there are many concerns and individuals now doing welding and many others who are planning on doing welding to serve their customers who do not realize the need of good welding equipment. They do not know much about welding except that it has become necessary to the successful serving of their trade, so they buy cheap, worthless equipment to get started, looking only at the price or first cost and hoping that any kind of apparatus will get them by, figuring that later on they can purchase better equipment.

Unfortunately it does not work out that way because the service station with good, dependable equipment has the best chance for success. A welding job done properly is a good business builder. It is impossible to hold trade with poor work. So every man who has anything to do with the success of the business, including the Purchasing Agent or Buyer, should know that four things are necessary in order that they may get the best results in their welding and cutting department and do the kind of work which will build their business:

1st. Dependable apparatus, including torches, regulators, hose and accessories.
2nd. Pure gases, both Acetylene and Oxygen.
3rd. The best welding rods and fluxes.
4th. Properly trained operators.

Production and service managers should specify and purchase welding and cutting torches that are efficient, economical, dependable, safe in operation and approved by the Underwriters' Laboratories.

They should specify and purchase both Acetylene and Oxygen regulators which are properly constructed so as to maintain a constant working pressure and equipped with safety features approved by the Underwriters' Laboratories.

They should use only acetylene and oxygen of the highest purity so as to get the greatest value in heat units when using the torches. This will mean less gas cost.

They should use only welding materials, such as rods and fluxes, of the best known quality. One of the fundamental requirements of successful welding is good materials. Good work cannot be done with cheap, worthless welding rods and fluxes.

It is also very important that the operator knows how to work the metal properly. Few welders can honestly claim to be proficient on all classes of welding. Then, too, many of the men in direct charge of welding know but very little about the fundamentals of welding. They should, however, be capable of inspecting the work from time to time to see that all welding is done properly.

Ninety-eight out of every hundred men using welding torches

want to do their work right and turn out an honest job, but most of them have had to find out for themselves the best way to start the job and have had to guess what the results would be. While they have turned out some wonderful work, they have made many mistakes; but they have profited by their mistakes and are now handling the work satisfactorily.

Much is being done today to help those who are using welding and cutting aparatus. Many colleges and schools, such as the Y. M. C. A., the K. C. schools and other technical and vocational schools now have real courses on welding. There are also many books on welding on the market which would be of great help to all who are interested.

To further the welding industry the American Welding Society was formed four years ago to look into and help solve the many problems of the users of this process. Some of the best engineers and leaders of the gas welding industry are devoting most of their time to this work. In the past few years local sections of the American Welding Society have been formed at New York, Boston, Schenectady, Buffalo, Philadelphia, Pittsburgh, Cleveland, Detroit, Chicago, Kansas City, Los Angeles and San Francisco and every effort is being made to form new sections in other cities where the welding industry is large enough.

The International Acetylene Association, The Compressed Air Manufacturers' Association and the Gas Products Association also have committees working to help the users of welding and cutting apparatus become familiar with what is essential for the operators of torches to know in order to do a real job and omit guesswork.

Gas welding is forging ahead steadily in the automotive industry because it is indispensable for production work. A very profitable business can also be built up for the service station, garage and repair shop if those in charge see that the operator knows what he is doing. No one should be permitted to use a torch on a job who does not understand the principles of gas welding. It is possible for any service station, garage or repair shop to develop a man or men who can weld different metals properly with the personal teaching and information they can secure at the present time from the different schools, societies and the manufacturers of welding equipment.

Electric Arc Process of Reclaiming and Scrapping Steel Freight Cars*

A. M. CANDY†

The life of a steel freight car before major repairs are required has been estimated by various authorities at from 15 to 25 years, depending upon the maintenance given the car and the service to

*Presented at the Oct., 1924, Meeting of the Chicago Section, A. W. S.
†General Eng'g Dept., Westinghouse Elec. & Mfg. Co.

which it is subjected. A very large share of the steel freight cars now in railway service have been on the road approximately this length of time and, therefore, it is not surprising to find that the railroads during the past few years have found that a large number of their cars needed immediate attention. This condition, together with the ruling of the Interstate Commerce Commission relative to the limitations of the number of bad order cars which the railroads were allowed to have on their systems has brought

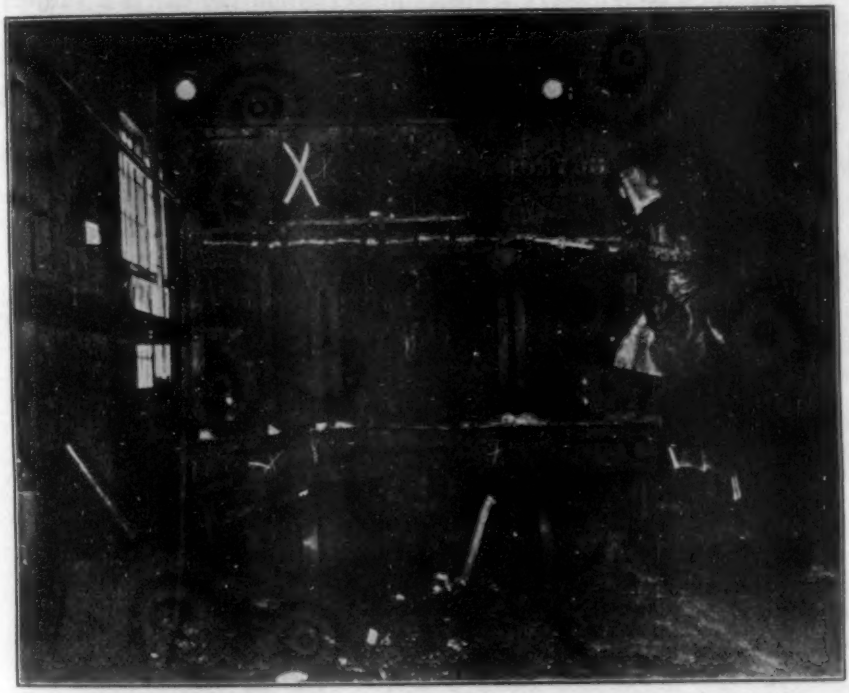

Fig. 1.—Typical Installation for Reclaiming Cars by the Arc Process

the properties face to face with the necessity for immediate action. In many cases this reclaiming and scrapping work has been handled on a contract basis either with companies specializing in this line of work or with the freight car builders themselves.

A number of articles in the Technical and Trade Press during the past year or eighteen months has demonstrated the fact, however, that the railroads have come to realize that they can compete very successfully with the junk man, so to speak, even with mediocre facilities for carrying on the scrapping and reclaiming work. Where proper facilities and modern apparatus is installed for doing this work the margin of profit which the railroads can show is very acceptable.

The problem of handling these bad order cars can be divided into two quite distinct fields, inasmuch as the class of work re-

quired is quite different. These two fields are (1) reclaiming and (2) scrapping. In the case of preparing bad order cars for reclaiming it is necessary to cut out the rivets with reasonable care so as not to destroy any side stakes or other material which may be of value. In the case of scrapping a car it can be cut up indiscriminately with much less care being exercised and, therefore, the intelligence of the operators can be of a lower order. When a car is in such condition that the side stakes, cross sills and center sills are in a satisfactory state of preservation the car is a subject for reclamation, the work required being that of cutting rivets and bolts so that the defective plates and fittings can be removed readily and new material re-riveted in position. Any necessary work can be done on the trucks and air brake equipment, after which the car is ready for painting and restoration to service.

In many instances, however, the cars are in such poor condition that the only salvage will be trucks, air brake equipment and possibly center sills. Such a car, therefore, is a straight scrap problem and can be disposed of much less expensively by straight away cutting of plates, stakes, angles, sills and other parts.

There are three general methods employed for doing this work, namely (1) air guns or "rivet busters", (2) oxyacetylene cutting torches and (3) the electric arc. It is not sufficient to say that any one of these processes is the best nor the cheapest because it will be found that there is a field for each.

Insofar as the actual operating cost is concerned the arc process, however, is actually cheaper. One road has made comparative tests in cutting rivets using air guns, oxy-acetylene torches and the arc process. The results being as follows:

Cutting 200 rivets ¾-in. Diameter From No. 1—CSA CAR.

Oxy-Acetylene Process	
Labor, one hour, 5 minutes, at 90 cents per hour,	$0.975
42 cu. ft. Prestolite 0.203 cents per cu. ft.,	0.960
200 cu. ft. Oxygen, 0.125c. per cu. ft.,	2.500
Backing off rivets	0.660
Total	$5.095
Hand-Cutting with Air Hammers	
Labor, 3 hours at 80c. per hour,	$2.40
3 hours labor for helper at 62c. per hour,	1.86
Cost of air consumed	0.20
Including back-off rivets total,	$4.46
Cutting by Arc Process	
Labor, 1 hour, 3 minutes, at 90c. per hour,	$0.945
Electric power,	0.800
Backing off rivets	0.660
Total	$2.405

A typical installation for reclaiming cars using the arc process for rivet cutting is shown by Fig. 1. It will be observed that platforms at a convenient height are provided along both sides of the cars, so that the operators can readily reach all the rivets. The resistor through which each operator obtains his cutting current is mounted overhead on wheels on a monorail so that it can be readily moved along the length of the car by the operator. The

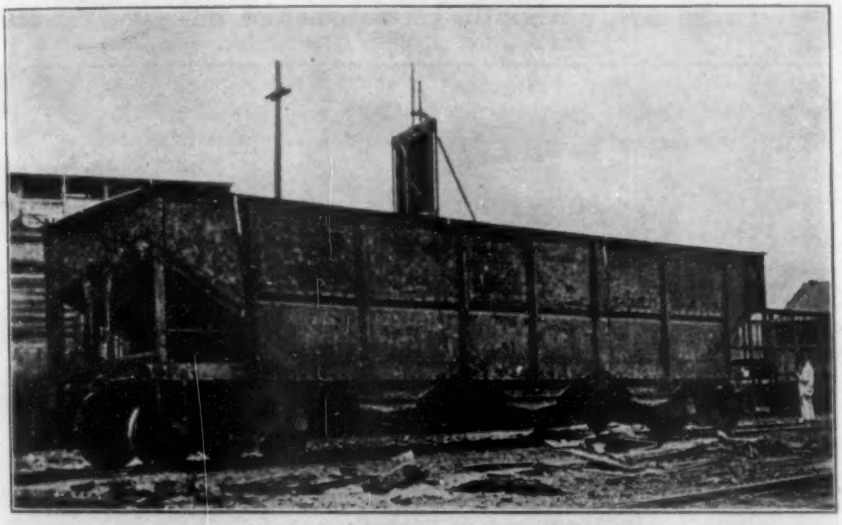

Fig. 2.—Cutting Through Plates and Frames

cutting cable is supported by the resistor carriage, which relieves the operator from dragging long cable leads over the floor. This undoubtedly makes an ideal installation. The current is supplied from four motor-generators operated in parallel to deliver 1000 amperes each, thereby providing capacity for a total of six cutters at one time, using from 400 to 600 amperes each.

The building is used exclusively for the work of cutting off the rivet heads. The cars are then removed to another building, where the rivets are backed out by means of air guns, the old plates are removed and new plates riveted in position.

At another installation, where cars are scrapped some rivet heads are cut off, but in addition sufficient cutting through the plates and angles is done (see Fig. 2), in a building similar to that illustrated above, so that the cars can be switched under a craneway as shown by Fig. 3. The car sides are then knocked out by the crane operator swinging a large skull cracker ball through the sides of the car. This ball can be seen in Fig. 3, poised in mid-air, appearing just above the rear crane track. In a few minutes' time the car is reduced to the condition shown by Fig. 4, where a gang using a rivet gun is shown cutting the few remaining rivets necessary for the complete destruction of the car.

Actual records at this plant show that ten men can cut up 36 cars per 22-hour day. Individual records show that the various operators will cut from 1800 to as high as 3100 rivets $\frac{5}{8}$ in. in diameter per 10-hour day.

It is manifestly obvious that the time required to cut up a car depends entirely upon the number of pieces into which the car is cut, or, in other words, the number of feet of cutting. In some instances as high as 240 to 250 feet of cutting is being done on 40-foot coke cars, whereas by careful analysis this same car can

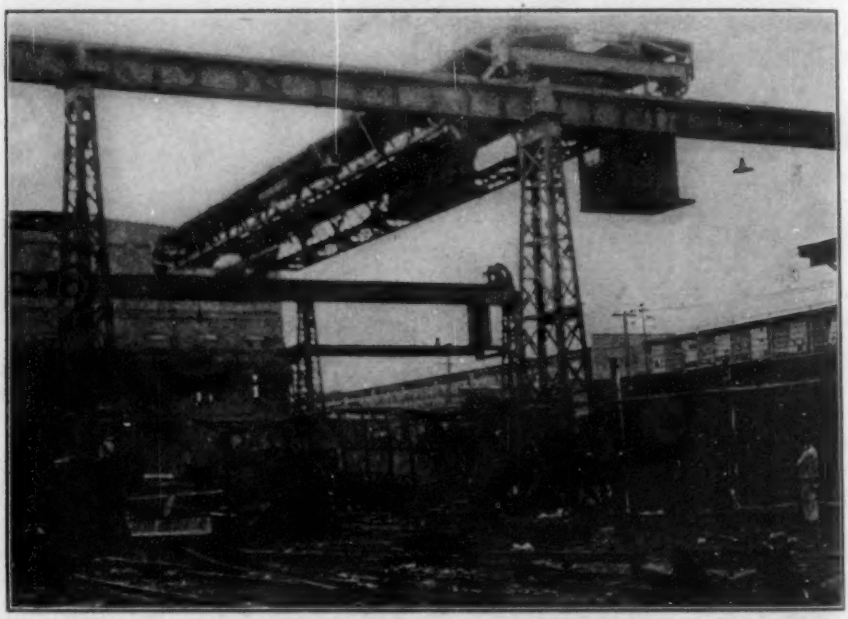

Fig. 3.—Craneway for Swinging Skull-Cracker

be cut into 14 pieces, involving 177 feet of cutting, the pieces being sufficiently small to load efficiently in a car. This cutting can be executed by one operator in $3\frac{1}{2}$ to 4 hours' time, the cost of labor at 60c. per hour and power for the motor generator equipment at 2c. per kilowatt-hour.

In the final analysis the size of the pieces into which a car must be cut is entirely dependent upon the material handling facilities of the company receiving the scrap. In some extreme cases it will be found permissible to cut a car straight through from side to side, cutting it into three or four sections, the sides of which can be mashed over against the bottom, where a crane is available to swing a skull cracker ball or an old truck.

One railroad company has found that it is only necessary to cut hopper bottom cars at the corners and around the sides just above the bottom, leaving the sides, ends and bottoms full size, approximately as follows:

Sides, 30 ft. 5 in. long by 9 ft. wide.
Bottom, 30 ft. 5 in. long by 9 ft. 6 in. wide.
Ends, 9 ft. 6 in. long by 4 ft. wide.

Gondola cars are cut at the corners and the sides and the bottom is cut across the center, making the sizes of the parts approximately as follows:

Sides, 20 ft. long by 4 ft. wide.
Ends, 9 ft. 6 in. long by 4 ft. wide.
Bottoms, 20 ft. long by 9 ft. 6 in. wide.

When planning an electrical installation for rivet cutting or car scrapping work, especial consideration must be given to the dis-

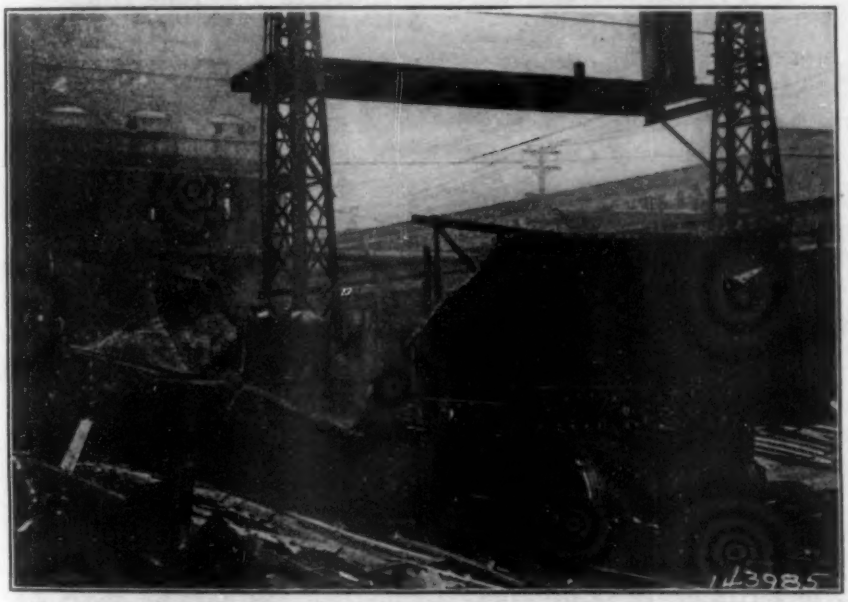

Fig. 4.—Cutting off the Few Remaining Rivets After Sides have been Demolished with Skull-Cracker

tribution system on account of the relatively high current values used and the relatively low generator voltage. Each cutting arc will be operated at 400 to as high as 800 amperes and the generator voltage will be approximately 60 volts. It is obvious, therefore, that where a number of cutters are employed the current to be handled will run into several thousand amperes, which will require the use of ample copper cable to keep the voltage drop within permissible limits, namely, not to exceed 5 per cent of the generator voltage at the point where each arc is to be used. When the track is to be used as a part of the transmission system all joints must be heavily bonded. In some installations no special provisions are made for conducting the current from the car body to the rails, but

it is allowed to flow through the truck center bearings, journals and wheels to the track. This, however, in some cases at least, is not entirely satisfactory and results in unnecessary loss, as the voltage drop through the truck center bearings is considerably higher than any other part of the car body. To determine definitely the actual voltage drop through such a car under actual working conditions the ground return cable and a voltmeter lead were bolted directly to one vertical corner angle of the car body and the electrode holder was pressed against various parts of the car. The other voltmeter lead was also connected to the same part of the car with the electrode holder. The results obtained are given in the following table:

Position of Electrode	Amperes	Volts Drop
First Side Stake	795	0.20
Sixth Side Stake	803	0.28
Top Angle	770	0.30
Far Side	811	0.30
Center of Center Sill	803	0.50
Near Draft Sill	750	0.75
Far Truck	803	3.80
Near Truck	750	4.20

Check readings were made on other similar cars and practically the same values were obtained, which makes it reasonable to assume that the figures are a good average value. It is manifestly obvious that if 800 amperes for cutting is carried through the car truck there is a dead loss of over 3 kw. with a voltage drop of 4 volts. At 600 amperes the loss is almost 2 kw.

To assist the operators in the cutting work it is advisable to have suitable scaffolding or platforms provided along the sides of the cars at a height of about 6½ feet. Each operator will require a cutting resistor which will have considerable weight. Therefore, it is advisable to locate a number of these resistors on about 40-foot centers under the platform, so that they will be protected from the weather. A suitable terminal should be provided at the resistor so that each operator can connect his cutting holder cable to the resistor readily.

The motor-generator and switchboard equipment should be located in a building which will give the apparatus complete protection from the weather. This also centralizes the equipment so that it can be given the proper attention by a competent electrical attendant. It is usually advisable to install two or more motor-generators of, say, 1000 amperes capacity each, to be operated in parallel when the current required is in excess of 1000 amperes, rather than one large machine, for several reasons. First, if one machine should fail, the plant can still be operated at a reduced capacity. Second, such a plant can be operated more efficiently,

because if the work for a given day demands only a portion of the available capacity, only a portion of the sets need to be operated.

Summary

Although the initial investment required for the electrical equipment to reclaim and scrap freight cars is higher than required by some methods, the resulting operating economy is so great that a very substantial dividend can be shown for each year of operation. For this reason and others every company which has given the electrical process a fair trial has adopted it for the major amount of their work.

TECHNICAL QUESTION AND ANSWER COLUMN

From time to time the Society is requested to furnish technical information on various welding problems. This information in many cases is of general interest and in order that it may be available to our members there is published in the Journal under the auspices of our research department, THE AMERICAN BUREAU OF WELDING, a Technical Question and Answer Column. Although the statements given below are expressions of opinion of competent engineers they do not involve the Society or Bureau in any way. The Society does not intend through the medium of this column to solve those welding problems which should fall in the province of a Consulting Engineer.

QUESTION

Is there any information available as to the comparative strength of welded steel flange on steel pipe versus cast iron screwed flange?

ANSWERS

G. O. Carter, Consulting Engineer, Linde Air Products Company.

"To the best of my knowledge there is no data with regard to the comparative strength of a welded steel flange on steel pipe versus cast iron screwed flange. However, a steel flange is superior in every respect.

"It must be appreciated, however, that the steel flange should be welded where the end of the pipe joins the surface, which is to meet another flange, and also on the opposite side of the flange to the side of the pipe.

"Probably the most satisfactory way of handling this problem is to weld flanges on short lengths of pipe and then make a circumferential weld to the main body of the pipe, a cut being made at the proper point so that the flange will fit evenly."

F. E. Rogers, Industrial Engineering Department, Air Reduction Sales Co.

"We know of no official test having been made to determine these comparative strengths. Erroneous conclusions may have been drawn from reports of welded cylinders and pressure containers, notably the papers read before the American Society of Mechanical Engineers' spring meeting, 1922.

"It is common experience, as pointed out in these reports, to find a welded nipple the weakest part of a pressure container when subjected to destructive tests. Some of the best welders fail in making nipple welds.

"The conditions in a welded cylinder, having nipples welded in the side, are quite different from those found in a welded flange. A cylinder, subjected to destructive tests, stretches, and the weld tends to pull away from the nipple, especially if the nipple is made of heavy pipe. It is a common mistake to use heavy pipe for nipples when, as a matter of fact, the nipple should have relatively thin walls, and thus be freer to follow the cylinder wall as it stretches under the internal pressure.

"Pipe flanges are made and welded in several ways, some forms being better than others. But a relatively poor job is generally far stronger than a screwed cast iron flange."

C. J. Holslag, Chief Engineer, Electric Arc Cutting & Welding Company.

"Steel flange welded on steel pipe can be made 100 per cent strength by ordinary arc welding methods. It has come to our attention that cast steel flanges can never be better than 25 per cent of the strength of the pipe. It is possible to get 100 per cent strength with a steel flange welded to a steel pipe."

QUESTION

We have had some difficulty in patching some aluminum turpentine kilns, especially when welding was done in a vertical position.

ANSWER

C. F. Nagle, Jr., Technical Direction Bureau, Aluminum Company of America.

"As I am not familiar with the nature of the difficulty that you experienced in your attempts to patch some turpentine kilns, I will simply describe how we would proceed to repair such a piece of equipment. I assume that the hole to be patched is at least an inch in diameter; in other words, too large to permit filling by means of molten weld metal. We would thoroughly clean the walls of the kiln both inside and outside by either sandpapering, filing, or scratch brushing, then enlarge the hole to some symmetrical shape, preferably a circle, using a saw in order to obtain a straight edge; then cut out a blank from a piece of aluminum sheet of similar thickness as the wall of the kiln, viz., 3/16 inch. This blank should make a reasonable fit with the hole in the kiln. The edge of the hole and the edge of this blank should both be beveled to an angle of about 45 deg., and to such a depth that the contact surfaces of the blank and wall will be approximately ⅛ inch thick. Both these ⅛-inch thick surfaces should then furthermore be notched at approximately every ½ inch.

"This beveling and notching is necessary in order to permit of completely melting through. In other words, it reduces the thickness of the place to be welded to approximately the thickness of sheets ⅛ inch thick, which is relatively an easy matter.

"The plate should then be inserted and the joint painted with the welding flux which is used. The successful welding of aluminum is a relatively easy matter, but it is essential to have a proper flux.

"The patch so prepared should then be tacked at several points in order to hold the blank in place. The actual welding of the joint should then proceed—starting at any point and progressing without interruption to completion. Care should be exercised to melt completely through at the joint, adding weld metal, preferably by means of a wire, as necessary, and completely filling up to a thickness greater than the thickness of the adjacent sheet, viz., greater than 3/16 inch. For this weld metal it is desirable to use an aluminum of fairly high purity. This welded seam should then be cold hammered to the thickness of the adjacent material, viz., 3/16 inch. This is for the purpose of converting the metal into a wrought condition and so increase its strength."

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release adjusting screws, regulators carefully made, gas will flow, insert tip

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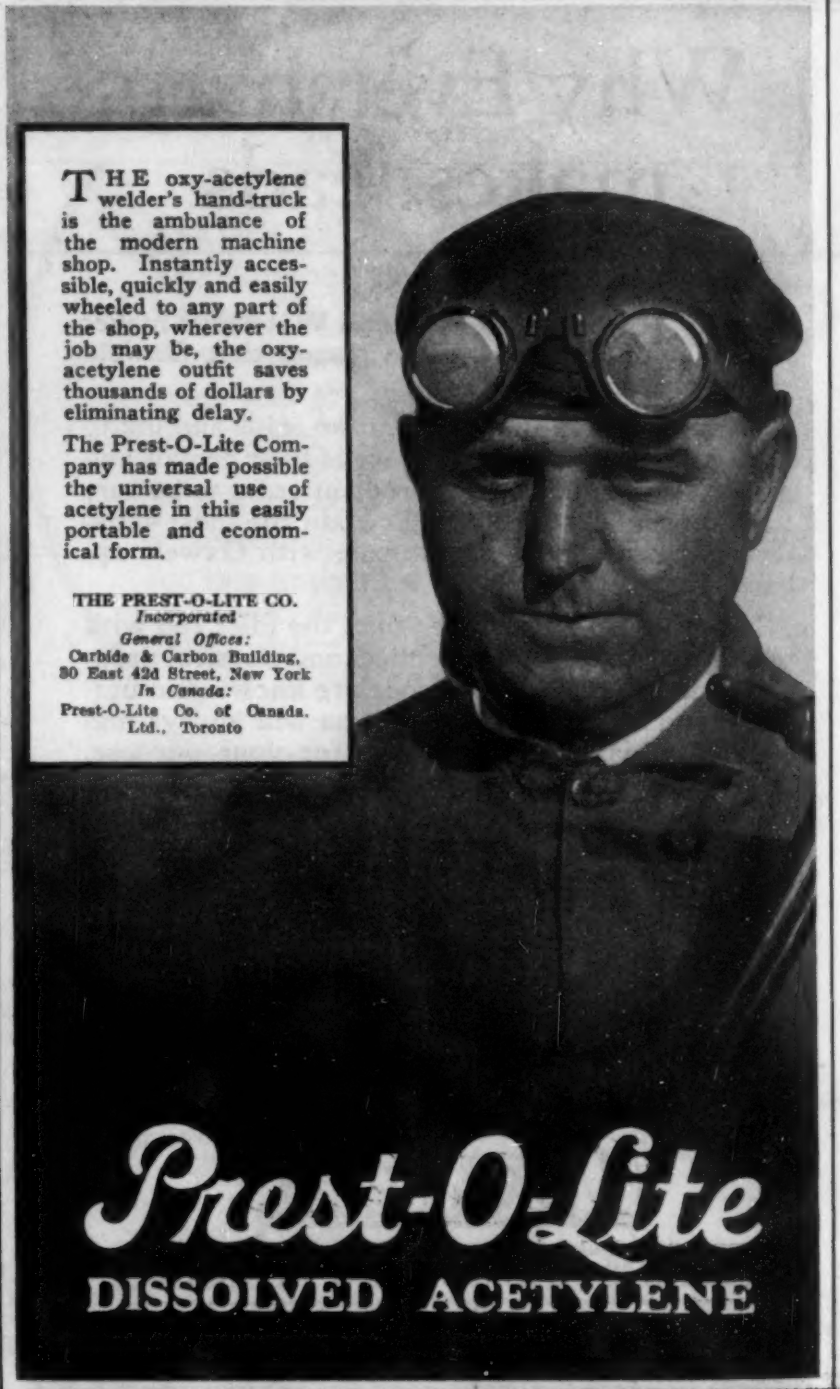
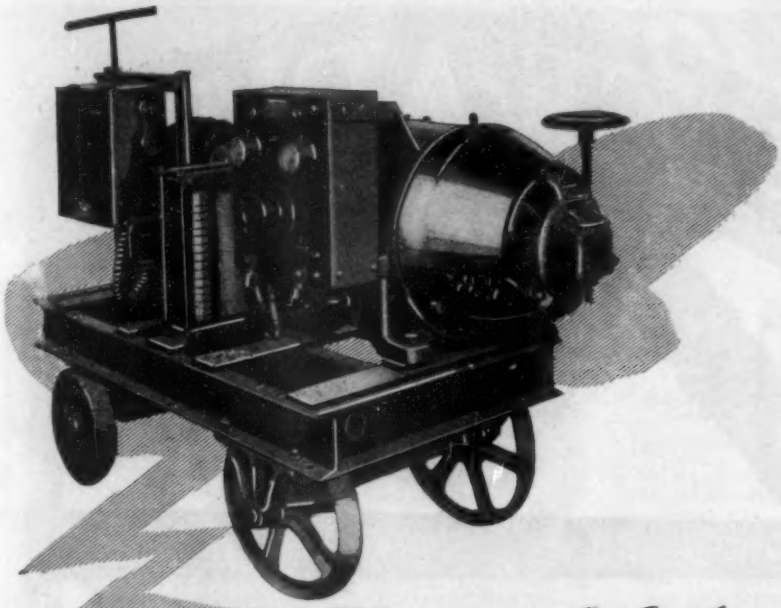
In Canada:
Prest-O-Lite Co. of Canada, Ltd., Toronto





Dependability!

—a feature of the WD-12 ARC WELDER

This welder can be depended on for strenuous and exacting service.

Standard G-E Motors are used on this equipment. They have the inherent excellence of design built into G-E Motors for over a quarter of a century. This excellence is maintained in every one of the parts of the WD-12 Arc Welding Set.

The integrity of General Electric equipment commends this welder to every user of arc welding equipment, who places *dependability* at the top of his list of requirements.

Ready to work when delivered.

The WD-12 Arc Welder
—can be furnished for any commercial voltage, phase or frequency.
—delivers 200 amperes continuously and 300 amperes for short periods.
—voltage can be adjusted to suit work.
—a two-unit machine (motor and generator).
—generator is self excited.
—reactor automatically steadies arc.
—handwheel on generator for regulating welding current.
—any value of welding between 75 and 300 amperes.
—all commercial sizes of electrodes, large or small.
—supplies power to G-E Automatic Arc Welder for continuous welding.

There is a suitable G-E welder for your every arc welding need. Ask the nearest G-E sales office for complete information.

General Electric Company
Schenectady, N. Y.
Sales Offices in all Large Cities

41B-884D

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PAGE-ARMCO

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To know at all times the qualities of the Welding metal definitely establishes one essential factor. Page-Armco Gas Welding Rods and Electrodes remove all doubt regarding the character of the welding metal.

The metal is uniform, assuring an even, uniform deposit of dense, clean metal, and a dependable weld.

They are the purest iron made commercially and a recognized standard.

Conform in all respects to A. W. S. specifications. Gas Welding Rods—Grade G No. 1-A. Electrodes—Grade E. No. 1-A. Gas Welding Rods, yellow tag and rod ends colored yellow. Electrodes, blue tag, and ends of rods colored blue.

PAGE HIGH CARBON
GAS WELDING RODS AND ELECTRODES

For Building Up Worn Rails and Other High Carbon Steel Parts, Page High Carbon Gas Welding Rods and Electrodes produce welds which equal or exceed the hardness of the original metal.

Smooth flowing qualities in the arc or gas flame is one of the desirable features. Conform in all respects to A. W. S. specifications. Gas Welding Rods—Grade G No. 1-C. Electrodes—Grade E No. 1-C. The ends of Page High Carbon Welding Rods are colored red and Bundles are tagged with red tags.

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Peerless Motor Car Co.
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General Motors Corp.
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and 35 others.

Railroads

Baltimore & Ohio
Canadian National
Big Four
Rock Island
Chicago & Northwestern
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Illinois Central
Pennsylvania
Santa Fe
Southern
Southern Pacific
and 59 others.

Oil Refineries

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Sinclair Refining Co.
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Vacuum Oil Co.
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Petroleum Iron Works
S. F. Bowser & Co.
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Pressed Steel Products

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Standard Steel Car Co.
Sterling Wheelbarrow Co.
The Truscon Steel Co.
Cleveland Metal Products Co.
Youngstown Pressed Steel Co.
Van Dorn Iron Works Co.
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American Sheet & Tin Plate Co.
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Illinois Steel Co.
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McDugall Duluth Co.
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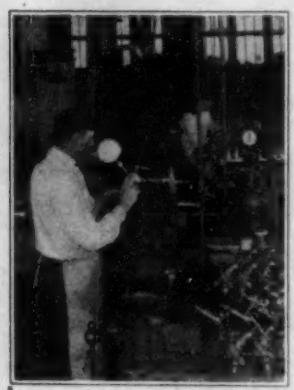
Means *Reliability* in Regulators



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Regulators have a hard life. Neglected, abused and in many cases knocked around, they are suddenly called upon to give full service—to withstand the hundreds of pounds of internal pressure—regulating to the fraction of a pound. To do this year after year, they must be built right.

Every REGO regulator is built right. *Every piece* that goes into the regulator is made, under constant inspection, in the REGO factory. There is no assembly of pieces or parts made by others. For that reason every REGO Regulator can be—and is—*guaranteed* to perform its duty accurately and positively.

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